

Appl. No. 10/065,665
Amdt. dated March 7, 2005
Reply to Office action of December 14, 2004

Amendments to the Claims

Listing of Claims:

- 5 Claim 1 (currently amended): A method of driving a liquid crystal display (LCD) device,
~~the LCD device comprising:~~
~~an LCD panel for displaying a plurality of pixels arranged in a matrix~~
~~format;~~
~~a voltage selection circuit for outputting a plurality of driving voltage~~
10 ~~levels according to display data; and~~
~~a plurality of output buffers, each output buffer electrically connected to~~
~~the voltage selection circuit and the LCD panel;~~
the method comprising:
(a-0) providing the LCD device with an LCD panel for displaying a
15 plurality of pixels arranged in a matrix format, a voltage selection
circuit for outputting a plurality of driving voltage levels according
to display data, and a plurality of output buffers, each output buffer
electrically connected to coupled between the voltage selection
circuit and the LCD panel;
20 (a) driving pixels located in a row by corresponding output buffers
according to corresponding driving voltage levels generated from the
voltage selection circuit;
(b) disconnecting the pixels from the corresponding output buffers; and
(c) connecting the pixels driven by the same driving voltage level for
25 equalizing voltages applied on the pixels and turning off the
operating voltages inputted into the corresponding output buffers.

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Claim 2 (cancelled)

Claim 3 (original): The method of claim 1, wherein each output buffer is an operational amplifier.

5 Claim 4 (original): The method of claim 1, wherein the voltage selection circuit comprises a plurality of conductive wires each for carrying one of the driving voltage levels and a plurality of digital-to-analog decoders (DACs) each for selecting one of the driving voltage levels from the conductive wires according to display data.

10 Claim 5 (currently amended): The method of claim 4, wherein the LCD device further comprises a plurality of switches each ~~having a first end selectively connected~~ connecting to either an output terminal of the output buffer to a corresponding pixel or ~~connecting an input terminal of the output buffer, and a second end connected to a~~ corresponding pixel.

15 Claim 6 (currently amended): The method of claim 5, wherein step (a) is performed by connecting the ~~first end of the switch in the row to the~~ output terminal of the output buffer to the corresponding pixel.

Claim 7 (currently amended): The method of claim 5, wherein step (b) is performed by connecting the ~~first end of the switch in the row to the~~ input terminal of the output buffer to the corresponding pixel.

20 Claim 8 (original): The method of claim 5, wherein step (c) the pixels predetermined to be driven to the same driving voltage level are connected to the same conductive wire which delivers corresponding driving voltage level.

Claim 9 (currently amended): The method of claim 1, wherein the LCD device

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further comprises:

a plurality of first switches each connected between an output terminal
of a corresponding output buffer and a corresponding pixel; and
a plurality of second switches each connected between two adjacent-
pixels for selectively connecting the adjacent two pixels.

Claim 10 (original): The method of claim 9, wherein step (a) is performed by:
turning on each first switch in the row for connecting the output buffer
to the corresponding pixel; and turning off each second switch in the
row.

Claim 11 (original): The method of claim 9, wherein step (b) is performed by
turning off each first switch in the row.

Claim 12 (original): The method of claim 9, wherein step (c) is performed by selectively
turning on the second switches on the row.

Claim 13 (original): The method of claim 1, wherein the LCD device further comprises a
timing controller for controlling the driving sequence of steps (a), (b), and (c).

Claim 14 (original): The method of claim 13, wherein the timing controller comprises: a
frequency divider for dividing the frequency of a clock signal according to a
predetermined divisor; a counter for counting the divided clock signal to generate a count
value; and a comparator for comparing the count value with a predetermined number to
generate a comparison result.

Claim 15 (original): The method of claim 14, wherein when the count value is equal to the
predetermined number, the comparison result generates a voltage level transition, and
step (b) and step (c) are performed.

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Claim 16 (original): The method of claim 14, wherein the frequency divider comprises an input port for receiving an input data to set the predetermined divisor.

- 5 Claim 17 (original): The method of claim 14, wherein the comparator comprises an input port for receiving an input data to set the predetermined number.

- 10 Claim 18 (original): The method of claim 14, wherein the timing controller further comprises a logic controller, and the logic controller comprises a first input port for receiving the comparator result to determine timing to perform steps (b) and (c).

- 15 Claim 19 (original): The method of claim 18, wherein the logic controller further comprises a second input port for receiving an external clock signal, and the logic controller determines whether to perform steps (b) and (c) according to the external clock signal.

- 20 Claim 20 (original): The method of claim 19, wherein the logic controller further comprises a third input port for receiving a selecting signal, and the selecting signal is used for controlling the logic controller to adopt either the comparison result or the external clock signal.

- 25 Claim 21 (currently amended): A liquid crystal display (LCD) device comprising:
an LCD panel for displaying a plurality of pixels arranged in a matrix format;
a voltage selection circuit for outputting a plurality of driving voltage levels according to display data;
a plurality of output buffers, each output buffer electronically connected to coupled between the voltage selection circuit and the LCD panel for driving the corresponding pixel by corresponding driving voltage level; and
a timing controller for controlling driving of the pixels, the timing controller comprising:
a frequency divider for dividing the frequency of a clock signal according to a

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predetermined divisor;
a counter for counting the divided clock signal to generate a count value; and
a comparator for comparing the count value with a predetermined number;
wherein ~~when the count value is equal to the predetermined number, the output buffers are~~
5 ~~disconnected from the corresponding pixels, operating voltages inputted into the~~
~~output buffers are turned off, and the pixels that are driven by the same driving~~
voltage levels are connected for averaging the voltage applied on the pixels according to
the predetermined number.

10 Claim 22 (original): The LCD device of claim 21, wherein the frequency divider comprised
an input port for receiving an input data to set the predetermined divisor.

Claim 23 (original): The LCD device of claim 21, wherein the comparator
comprises an input port for receiving an input data to set the
15 predetermined number.

Claim 24 (original): The LCD device of claim 21 wherein the timing
controller further comprises a logic controller, and the logic controller
comprises a first input port for receiving a comparison result outputted
20 from the comparator to determine whether the count value is equal to
the predetermined number or not.

Claim 25 (original): The LCD device of claim 24 wherein the logic
controller further comprises a second input port for receiving a control
25 signal, and the logic controller determines whether the output buffers
are disconnected from the corresponding pixel, and the pixels that are
driven by the same driving voltage level are connected for averaging the
voltage inputted into the pixels according to the control signal.

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Claim 26 (original): The LCD device of claim 25 wherein the logic controller further comprises a third input port for receiving a selecting signal, and the selecting signal is used for controlling the logic controller to adopt either the comparison result or the control signal.

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Claim 27 (cancelled)

Claim 28 (currently amended): A driving device for driving a liquid crystal display (LCD) device, the LCD device comprising an LCD panel having a plurality of pixels arranged in a matrix format, said driving device comprising:

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a voltage selection module comprising a power supply having a plurality of power transmission lines for carrying a plurality of voltages, and a plurality of decoders each selectively outputting one of the voltages from the power transmission lines according to display data; and

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a plurality of driving units each electrically coupled to the one of said decoders, each driving unit comprising an output buffer and a switch, a first end of said switch being selectively connected to either an output terminal of said output buffer or an input terminal of said output buffer, a second end of said switch being connected to an output terminal of said driving unit;

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wherein the first end of said switch is first connected to the output terminal of said output buffer for driving an output voltage of the driving unit toward a voltage transmitted via one of the power transmission lines of said power supply, [[and]] the first end of said switch is then connected to the input terminal of said output buffer for driving the output voltage of said driving unit toward an average voltage generated from averaging voltages at output terminals of said

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driving units that are connected to the same power transmission line through corresponding decoders, and an operating voltage inputted into said output buffer is turned off when the first end of said switch is connected to the input terminal of said output buffer.

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Claim 29 (original): A driving device for driving a liquid crystal display (LCD) device, the LCD device comprising an LCD panel having a plurality of pixels arranged in a matrix format, said driving device comprising:

- 10 a plurality of decoders each for selectively outputting one of a plurality of voltages according to display data;
a plurality of driving units each electrically connected to one of said decoders, said driving unit comprising:
an output buffer;
15 a first switch connected between an output terminal of said output buffer and an output terminal of said driving unit, the output terminal of said output buffer being electrically connected to the output terminal of said driving unit when said first switch is turned on; and
20 a second switch connected between the output terminal of said driving unit and an output terminal of another driving unit, the output terminal of said driving unit being electrically connected to the output terminal of another driving unit when said second switch is turned on;
25 wherein said first switch is first turned on to drive an output voltage of said driving unit toward a voltage from corresponding decoder, and said second switch is then selectively turned on to drive the output voltage of said driving units toward an average voltage generated from averaging voltages at output terminals of said driving units.

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Claim 30 (original): A driving device for driving a flat panel display including a plurality of pixels arranged in a matrix format, said driving device comprising:

- 5 a first driving units receiving a first voltage and being provided to drive the pixels of the flat panel display, said first driving unit comprising:
- a first output buffer;
- 10 a first switch electrically connected between an output terminal of said first output buffer and an output terminal of said first driving unit;
- a second driving units receiving a second voltage and driving the pixels of the flat panel display, said second driving unit comprising:
- a second output buffer;
- 15 a second switch electrically connected between an output terminal of said second output buffer and an output terminal of said second driving unit;
- a third switch electrically connected between the output terminal of said first driving unit and the output terminal of said second driving unit;
- 20 and
- a detecting circuit for controlling said third switch according to the first voltage and the second voltage.

- Claim 31 (original): The driving device of claim 30, said third switch is
- 25 turned on if the first voltage and the second voltage are substantially the same.

Claim 32 (original): A driving device for driving a flat panel display including a plurality of pixels arranged in a matrix format, said driving

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device comprising:

- 5 a first driving units receiving a first input driving data and being
provided to drive the pixels of the flat panel display according to
said first input driving data, said first driving unit comprising:
a first output buffer;
a first switch electrically connected between an output terminal of
said first output buffer and an output terminal of said first
driving unit;
10 a second driving units receiving a second input driving data and being
provided to drive the pixels of the flat panel display according to
said second input driving data, said second driving unit comprising:
a second output buffer;
a second switch electrically connected between an output terminal of
said second output buffer and an output terminal of said second
15 driving unit;
a third switch electrically connected between the output terminal of said
first driving unit and the output terminal of said second driving unit;
and
a detecting circuit for controlling said third switch according to the first
20 input driving data and the second input driving data.

Claim 33 (original): The driving device of claim 32 wherein said third
switch is turned on if the first input driving data and the second input
driving data are the same.

25 Claim 34 (new): A method of driving a liquid crystal display (LCD) device,
the method comprising:
providing the LCD device with an LCD panel for displaying a plurality
of pixels arranged in a matrix format, a voltage selection circuit for

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outputting a plurality of driving voltage levels according to display data, a plurality of output buffers, a plurality of first switches, and a plurality of second switches, each output buffer electrically coupled between the voltage selection circuit and the LCD panel,
5 each first switch coupled between an output terminal of a corresponding output buffer and a corresponding pixel, and each second switch connected between corresponding two pixels for selectively connecting the corresponding two pixels;
controlling the first switches for connecting the pixels to the
10 corresponding output buffers;
driving pixels located in a row by corresponding output buffers according to corresponding driving voltage levels generated from the voltage selection circuit;
controlling the first switches for disconnecting the pixels from the
15 corresponding output buffers; and
controlling the second switches for connecting the pixels driven by the same driving voltage level for equalizing voltages applied on the pixels.

- 20 Claim 35 (new): A method of driving a liquid crystal display (LCD) device, the method comprising:
- (a) providing the LCD device with a timing controller, an LCD panel for displaying a plurality of pixels arranged in a matrix format, a voltage selection circuit for outputting a plurality of driving voltage levels
25 according to display data, and a plurality of output buffers, each output buffer electrically coupled between the voltage selection circuit and the LCD panel;
- (b) driving pixels located in a row by corresponding output buffers according to corresponding driving voltage levels generated from the

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- voltage selection circuit;
- (c) disconnecting the pixels from the corresponding output buffers;
- (d) connecting the pixels driven by the same driving voltage level for equalizing voltages applied on the pixels; and
- 5 (e) controlling driving sequence of steps (b), (c), and (d) through the timing controller, wherein the timing controller comprises a frequency divider receiving an input data to set a predetermined divisor for dividing the frequency of a clock signal according to the predetermined divisor, a counter for counting the divided clock signal to generate a count value, and a comparator for
- 10 comparing the count value with a predetermined number to generate a comparison result.

Claim 36 (new): A method of driving a liquid crystal display (LCD) device, the method comprising:

- 15 (a) providing the LCD device with a timing controller, an LCD panel for displaying a plurality of pixels arranged in a matrix format, a voltage selection circuit for outputting a plurality of driving voltage levels according to display data, and a plurality of output buffers, each output buffer electrically coupled between the voltage selection
- 20 circuit and the LCD panel;
- (b) driving pixels located in a row by corresponding output buffers according to corresponding driving voltage levels generated from the voltage selection circuit;
- (c) disconnecting the pixels from the corresponding output buffers;
- 25 (d) connecting the pixels driven by the same driving voltage level for equalizing voltages applied on the pixels; and
- (e) controlling driving sequence of steps (b), (c), and (d) through the timing controller, wherein the timing controller comprises a frequency divider for dividing the frequency of a clock signal

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5 according to the predetermined divisor, a counter for counting the divided clock signal to generate a count value, a comparator for comparing the count value with a predetermined number to generate a comparison result, and a logic controller having a first input port for receiving the comparator result to determine timing to perform steps (b) and (c).

Claim 37 (new): A liquid crystal display (LCD) device comprising:

- 10 an LCD panel for displaying a plurality of pixels arranged in a matrix format;
a voltage selection circuit for outputting a plurality of driving voltage levels according to display data;
a plurality of output buffers, each output buffer electronically coupled between the voltage selection circuit and the LCD panel for driving the corresponding pixel by corresponding driving voltage level; and
15 a timing controller for controlling driving of the pixels, the timing controller comprising:
a frequency divider for receiving an input data to set a predetermined divisor and for dividing the frequency of a clock signal according to the predetermined divisor;
a counter for counting the divided clock signal to generate a count value; and
a comparator for comparing the count value with a predetermined number;
20 wherein the output buffers are disconnected from the corresponding pixels, and the pixels that are driven by the same driving voltage levels are connected for averaging the voltage applied on the pixels according to the predetermined number.

- 25 Claim 38 (new): A liquid crystal display (LCD) device comprising:
an LCD panel for displaying a plurality of pixels arranged in a matrix format;
a voltage selection circuit for outputting a plurality of driving voltage levels according to display data;
a plurality of output buffers, each output buffer electronically coupled between the voltage

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selection circuit and the LCD panel for driving the corresponding pixel by
corresponding driving voltage level; and
a timing controller for controlling driving of the pixels, the timing controller comprising:
a frequency divider for dividing the frequency of a clock signal according to the
5 predetermined divisor;
a counter for counting the divided clock signal to generate a count value;
a comparator for comparing the count value with a predetermined number; and
a logic controller for receiving a comparison result outputted from the comparator to
determine whether the pixels driven by the same driving voltage levels are connected
10 for averaging the voltage applied on the pixels or not.

Claim 39 (New): A driving device for driving a display panel including a
plurality of pixels arranged in a matrix format, the driving device
comprising:

15 a voltage selection circuit for outputting a plurality of driving voltage levels according to
display data;
a plurality of output buffers, each output buffer coupled between the voltage selection
circuit and the display panel for driving the corresponding pixel by corresponding
driving voltage level;
20 a plurality of first switch circuits each coupled between an output terminal of a
corresponding output buffer and a corresponding pixel;
a plurality of second switch circuits each coupled between two pixels for
selectively connecting the two pixels; and
a control circuit controlling the second switch circuit to connect the two
25 pixels according corresponding display data or the corresponding driving
voltage level.